representation of one revolution around a disc for a given track. The track is assumed to represent a constant distance from the center of the disc.

[0038]   As the next step 604, a moving average of the slope (developed at step 602) of a plurality of adjacent tracks is generated, before any derivative is taken. The use of the moving average, the sequence of data points for the processor where each point is the moving average for L tracks, where each track is represented by the circumferential average slope for the entire track as developed at step 602. The radial length of the number of tracks L in each moving average developed by the processor is chosen to eliminate spikes from appearing in the differentiation which is to follow, while still maintaining a lateral resolution moving radially across the surface of the disc, which is much smaller than the width of a head. This step 604 provides a measurement of the surface profile of the disc which is much more accurate than approaches taken in the prior art.

[0039]   After the averaging step, then the derivative is taken, step 606, directly yielding the curvature profile of the disc (as shown for a set of discs in Fig. 7B below).

[0040]   The result of the method described with respect to Fig. 6 is to provide a very accurate curvature profile moving radially outward across the disc. By using this curvature profile, the disc manufacturer can test discs at the substrate level. The test described determines whether each disc will lend itself to flying a slider at a desired height as established by the disc drive specifications over the surface of the disc without colliding with the disc and while maintaining an idea separation gap from the surface of the disc to optimize recording density and accuracy. This curvature profile is in contrast to the glide avalanche testing method, which essentially comprises flying a slider over the surface of the finished disc periodically moving outwardly along a radius, until the slider collides with the surface of the disc. This glide avalanche method, can only be conducted on a finished disc, and is essentially a destructive testing method, i.e., since there has been a collision between the slider and the surface of the disc, moot discs which have been tested according to the glide avalanche method are considered not usable because of lost surface storage area.

[0041]   The distinction between glide avalanche testing and the curvature profiling of the present invention becomes more apparent from a study of Fig. 7A and 7B. Fig.

7A shows the results of glide avalanche testing and can be directly converted into a selection of a appropriate or minimum fly height of the slider over the surface of the disc. Looking at the Fig. 7A, it can be seen that if a slider is flown at a height of 6nm over the surface of a discs of Group A, that the outer most radii for a data track should be at a height of about 40.2 mm for the discs of Group A, but could extend out as far as about 40.8 mm for the discs of Group B. The data clearly demonstrates that the discs of Group A are weaker and have more curvature than the discs of Group B.

[0042] In contrast, using curvature profiling, a more direct measurement of the actual curvature profile of each disc, as tested typically at the substrate level, can be found. To determine an appropriate fly height for any group of discs, this curvature profile is used as an input to a model which also incorporates the desired fly height of the slider. Thus, the curvature profiling of Fig. 7B can be much more sensitive to different models of disc drives utilizing different sliders and different desired fly heights over the surface of the disc. The advantage of the curvature profile developed by the present invention is that it directly provides the user with the curvature of the disc in the region where roll-off occurs. This represents another distinct advantage of this invention over the prior art because the curvature profile, which is shown, for example, in Fig. 7B is slider independent. That is, given the curvature profile, any particular disc drive and particular slider design can be chosen, and then matched with discs, for example, selected from Group A which has a typical profile as shown by the solid line 702 as shown in the figure or the discs of Group B (which has a typical profile or control line 702). Each group of discs has a different typical curvature profile for optimum performance on the particular characteristics of the slider and the desired capacity and other specifications of the disc drive in which the disc or discs are used.

[0043] In summary, the objective of this invention is to provide a substrate control tool, which is independent of the type of slider which is to be flown over the finished disc. Thus, by doing some preliminary samples of discs, the user could set the standard either at line control 700 or at control line 702 or any other line that represents a target specification to be met. Then, any substrate which test which fall below the line 700, which represents the target for substrates to be used in a particular disc drive with a particular slider, will be passed. In contrast, for a different disc drive with a different

10

specification and a different slider, the target or standard may be set at profile line 702. Any disc which is above line 702 can be expected to fail when used in that disc, whereas any disc falling below that line is useful and will pass. Obviously, the standard established by profile line 702 is substantially more rigorous than line 700; this process gives the advantage of being able to choose different standards for different disc drives with different specifications and different sliders. Thus, given the profile of line 700, all the discs of Group A are grouped very closely to this line and would probably all pass; all the discs of Group B which are grouped around profile line 702 would certainly pass. In contrast, for the discs of Group B, if the target profile is that of line 702, all the discs of Group B would probably pass since they are grouped close to that profile line. But none of the discs of Group A would pass.

[0044]   In fact, meeting the entire profile line or part of line 700, or 702 may not be necessary; a single point or points along the profile or control line could be defined as critical, and any substrate which falls below that point would be considered to be useful or successful in the disc drive of choice.

[0045]   Tables 8 and Figs. 9A and 9B compare the results of data gained from glide avalanche testing of four different cells or groups of discs (See Table 8). The same cells or groups of discs are also tested using the present curvature profile method. Table 8 records the data as glide radii in mm at tested fly heights (in nm). The average glide radii of each cell is calculated and tabulated in the highlighted rows. For comparison, the substrates of cells 1 and 2 are tested using the method of the present invention, with the results recorded and displayed in Fig. 9A; and cells 3 and 4 are tested and the results recorded and displayed in Fig. 9B. In this experiment, discs of two different OD sizes, were deliberately chosen. The discs in cells 3 and 4 are 0.2 mm larger in OD size than the discs in the cells 1 and 2.

[0046]   Table 8 reports the results of the glide avalanche testing of all four cells or groups of discs. The discs were tested at given fly heights and the radii at which the glide signals avalanched were recorded. (The avalanche radii being the radius at which the slider makes contact with the disc.) The average of cells 1 and 2 (See Table A) shows a distinguishable difference in glide avalanche performance; the discs of cell 2 have consistently larger glide radii than cell 1 does at all four glide heights. This